Contribution ID: **393** Type: **Oral Presentation**

Material balance and mixing behavior during emulsification of crude oil by using micro-X-ray tomography

Wednesday, 2 June 2021 14:15 (15 minutes)

The mixing behavior of oil and water is usually evaluated outside the pore space, under mixing conditions that does not correspond to porous media flow and by optical inspection. Especially the optical inspection disregards that, e.g., a little oil contamination in water may lead to a substantial coloring of the aqueous phase. A quantitative material balance is therefore difficult, if not impossible. In this study, we use the linear mass absorption coefficient of micro-X-ray tomography to establish the material balance during emulsification in classical test-tube experiments and in the porous medium under flow conditions.
With these methods we investigate the phase behavior and the displacement properties of crude oil from the Vienna Basin by alkaline injection waters with different Na2CO3 concentrations. In alkaline flooding, in-situ surfactants are generated by saponification reactions between fatty acids and the alkali, which reduces the interfacial tension between oil and water and ultimately forms emulsion phases. In contrast to the ideal surfactant systems typically examined (surfactant solution and synthetic oil), emulsification leads to a more complex phase behavior that does not follow the classic Winsor regime and does not have clear optimal conditions.
We conduct and evaluate classic phase behavior experiments in test tubes, but by using micro-X-ray tomography. We show that the typical visual assessment is misleading and that for X-rays the assessment is conclusive and takes the material balance into account. We find the same fluid phase signature in micro-CT-based core flood experiments under flow conditions as in the test tubes. We show that, in contrast to earlier statements on the same system by other groups, a mutual minimal emulsification can be identified as optimal, which leads to the best recovery. Furthermore, micro-X-ray tomography provides spatial information about fluid distributions in the pore space and enables statements about the relative permeability and its changes.
The study shows the necessity of using X-ray-based methods to evaluate and quantify complex phase behavior as in case of complex crude oils and alkaline flooding. Using X-ray-based methods makes observations in test tubes and in the pore space comparable and leads to conclusive statements for injection water optimization.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Primary authors: BORJI, Mostafa (Montanuniversitat Leoben); KHARRAT, Ahmad; RITTER, Rene (Montanuniversität Leoben); ARNOLD, Pit; OTT, Holger (Montanuniversität Leoben)

Presenter: BORJI, Mostafa (Montanuniversitat Leoben)

Session Classification: MS6-A

Track Classification: (MS6-A) Physics of multi-phase flow in diverse porous media